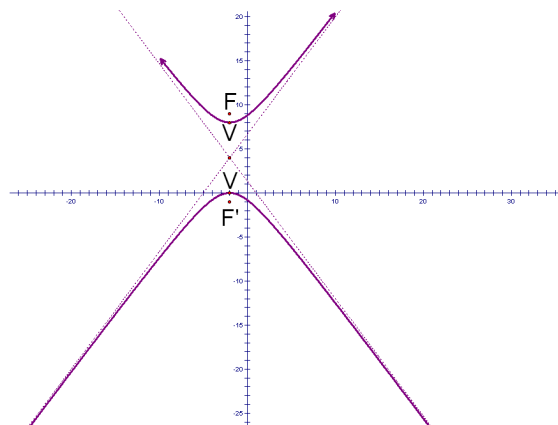


## 8.5 Hyperbolas

Hyperbola--the set of all points such that the absolute value of the difference of the distances from a point to two fixed points (foci) is a constant



gsp

### Visual of construction

Focal radii--distances from the foci to a point P on the curve

Opens left/right

$$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$$

Opens up/down

$$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$$

a is not necessarily the largest, but first.

a = distance from center to vertex

b =

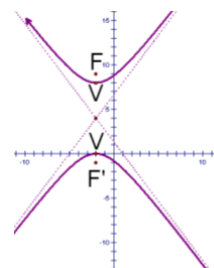
c = distance from center to each focus

Transverse axis--line segment of length  $2a$  that intersects the hyperbola in 2 points (vertices)

Conjugate axis--perpendicular to transverse axis and has a length of  $2b$

$$a^2 + b^2 = c^2$$

asymptote--line such that the distance between this line and a point, P, on the graph goes to 0 as the distance between P and the center becomes greater and greater.



Equations of asymptotes

With a center of  $(0, 0)$ .

Left/Right

Up/Down

$$y = \frac{b}{a} \quad y = -\frac{b}{a} \quad \left| \quad y = \frac{a}{b} \quad y = -\frac{a}{b} \right.$$

With a center of  $(h, k)$ , the y-intercept is not zero, so you must figure it out.

Graph and find the equation of asymptotes

$$C(-2, 4)$$

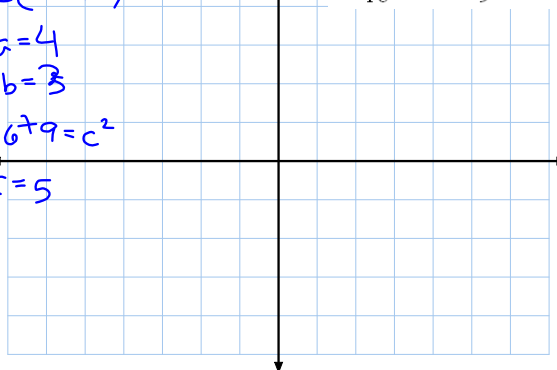
$$a = 4$$

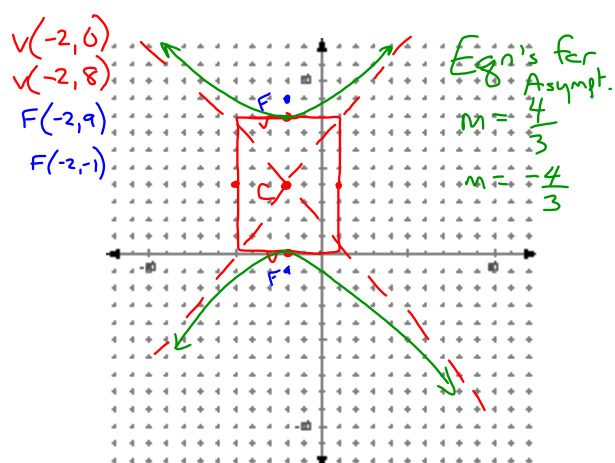
$$b = 3$$

$$16 + 9 = c^2$$

$$c = 5$$

$$\frac{(y-4)^2}{16} - \frac{(x+2)^2}{9} = 1$$





$(-2, 4) \quad m = \frac{4}{3}$   
 $y - 4 = \frac{4}{3}(x + 2)$

Point slope  
 $y - y_1 = m(x - x_1)$

$(-2, 4) \quad m = -\frac{4}{3}$   
 $y - 4 = -\frac{4}{3}(x + 2)$

Graph and find the equation of asymptotes

$$\frac{x^2}{36} - \frac{y^2}{81} = 1$$

$$C(0, 0)$$

$$a = 6$$

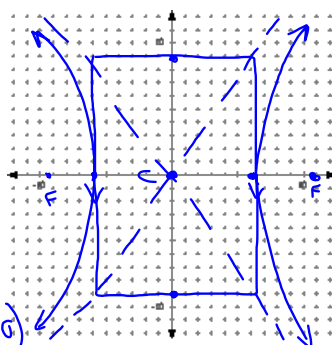
$$b = 9$$

$$c = 3\sqrt{13} \quad (\sqrt{17})$$

$$\approx 10.8$$

$$V(6, 0) \quad F(\pm 3\sqrt{13}, 0)$$

$$V(-6, 0)$$



Write the equation of a hyperbola with  $C(0, 0)$ .  
Horizontal transverse axis,  $a = 8$ ,  $b = 5$

$$\frac{x^2}{64} - \frac{y^2}{25} = 1$$

Write the equation of a hyperbola with F(10, 0) and F(-10,0).  $2a = 16$

$$C(0,0) \quad a = 8$$

$$c = 10$$

$$\frac{x^2}{64} - \frac{y^2}{36} = 1 \quad \begin{array}{l} 64 + b^2 = 100 \\ b^2 = 36 \end{array}$$

Write the equation of a hyperbola with V(1, -2) and V(1,2).  $b = 2$

HW

p445-446

11-19odd, 23, 31,33

Attachments

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hyperbola\_trans\_sketch.gsp